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ABSTRACT

Notes from a diary kept on the language acquisition of a child from age 11 to 22 months, through four developmental stages, were used to investigate the interaction between the child's phonological systems and his developing syntactic system in the context of research on the emergence of multiword combinations. The presence of a phonological selection strategy and consonant harmony rule was discovered, with evidence that this consonant harmony rule operated across morpheme boundaries with the effect of both delaying the onset of two-word utterances and influencing the selection of words that could occur in combinations. The study provides an explicit example of the role that word-level articulatory planning may play in constraining the occurrence and nature of word combinations. The child's transition from single- to two-word utterance is a struggle to work within and overcome his consonant harmony rules. It is not likely that this is a typical or common pattern, since few similar reports are available in the literature. However, this and other research may help to clarify the notion of language learning styles. (MSE)

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PHONOLOGICAL CONSTRAINTS ON THE EMERGENCE OF TWO-WORD UTTERANCES

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Paper presented at the Boston University Conference on Language Development, Boston, MA, October, 1984.

ABSTRACT

Considerable interest has been generated in the linguistic and cognitive factors influencing the onset of early combinatorial speech. The present diary study provides evidence that the transition between the single-word and two-word stages may be governed by phonological constraints. The presence of a phonological selection strategy and consonant harmony rule in one child's developing phonological system is described. Evidence is presented suggesting that this consonant harmony rule operated across morpheme boundaries. This had the effect not only of delaying the onset of two-word utterances, but also of influencing the selection of words that could occur in word combinations. The implications of these findings for explaining individual variation in the transition from single-word to combinatorial speech are discussed.

Much of the research on early language acquisition has been motivated by a search for universals in the nature and sequence of various aspects of language development. More recently, this concern for universal patterns has given way to an interest in describing and accounting for individual differences in children's approach to the language acquisition task. One particularly fertile site for the investigation of individual routes to the acquisition of syntax is the transition phase between the use of primarily one-word utterances and the onset of early combinatorial speech.

A number of investigators have discussed possible linguistic and cognitive prerequisites to the emergence of two-word utterances (Bloom, 1973; Braine, 1976; Branigan, 1979; Dore et al., 1976; Garman, 1981; Nelson, 1973; Ramer, 1976; Rodgon, 1976; Scollon, 1976). Among the factors considered to influence the onset of word combinations are the number of single items in the child's vocabulary , the physiological ability to produce more than one utterance, the semantic or cognitive ability to mark relatio among objects and events in the same situation, and the syntactic knowledge to encode grammatical structures, typically in patterned word order. In light of the findings that there is a great deal of variability in children's routes from the primary use of single words to the primary use of phrases (Dore et al., 1976; Ramer, 1976), it is not surprising that characterization of the emergence of two-word utterances as either a cognitive or a linguistic feat remains controversial.

Branigan (1979) has argued that the onset of multi-word combinations is governed by production or articulatory constraints, namely, the child's increasing ability to engage in articulatory planning over larger linguistic

units. He provides the example of what Bloom (1973) called "successive single word utterances", sequences of single words commenting on the same situation, often occurring just before and during the onset of true multi-word combinations. Several investigators (Bloom, 1973; Dore, 1975; Rodgon, 1976; Scollon, 1976) rejected successive single word utterances as evidence for early syntactic knowledge, due to the claim that each word had the prosodic shape of a single word, namely, falling pitch contours and distinct pauses between words. Branigan refuted this claim by showing that successive single word utterances share intonational and temporal features of multi-word combinations. He concluded that successive single word utterances differ from multi-word utterances not in a lack of syntactic or semantic knowledge, but rather in the efficiency with which such knowledge is organized and carried out at an articulatory level. In other words, "the transition between the one- and two-word periods is one in which articulatory plans are undergoing reorganization to include syntactic and semantic information" (p. 420).

Another example of how a production or articulatory constraint may influence the emergence of two-word utterances is provided by Waterson (1978), in her diary study of her son from the onset of word use until age 2. In an analysis of the type and number of articulatory or phonetic contrasts within a syllable, contrasts of syllables within words, and contrasts of words within multi-word utterances, she suggested that the same sets of contrasts that were evident in his planning and production of early single-word utterances also appeared in first word combinations. Thus, there appeared to be a trade-off in complexity, in that new and more syntactically complex utterances were no more phonetically complex and sometimes less complex, than were single-word

utterances used in the same period. In fact, Waterson claimed that if these constraints on articulatory retrieval, planning and execution were not present, "children would start using longer utterances much earlier than they do (p. 438).

The purpose of the present case study is to provide some support for the Branigan and Waterson claims by describing an interaction between one child's phonological system and his developing syntactic system. It is proposed that this child had a pervasive and powerful consonant harmony rule that not only specified the phonetic form of single words, but also operated across word boundaries. This had the effects of (1) delaying the onset of two-word utterances, and (2) influencing the selection of words that could occur in early combinations.

Method

The data are based on a diary study of the early language development of the author's son, Sean. Frequent diary notes were collected from the onset of single words at about 11 months to the use of primarily multi-word utterances at about 22 months. Sean was a first born and only child, but was in full-time family day care from the age of 4 months. Therefore, his language environment was more typical of that of a later-born child in a large family, at least during the day.

Data are presented from 4 developmental phases, shown in Tables 1, 2, and 3.

PHASE 1. This phase, from about 11 to 15 months, showed the fairly slow acquisition of single words. The phonetic shapes of these early words were characterized by the presence of only one consonant, taking the syllabic

patterns of CV, VCV, or VC, or reduplicated syllables such as "mama" or "baby." This was accomplished through initial or final consonant deletion (as in "hat, water" or "nuk, bird"), but also because many of the words selected to be produced already conformed to these shapes. By the end of Phase 1, after about 35 different words had been learned, some evidence of another phonological selection strategy appeared. Sean not only produced no velar stop consonants, but only 3 of his 35 target words even contained a velar (namely, "kitty" pronounced as [tyi], "hockey", where the [k] was realized as a glottal stop, and "yuk", whose final segment was a velar fricative). These patterns fit the increasing evidence that children in the early one-word stage target words that fit certain predetermined phonological or syllabic constraints and avoid the use of words that violate those constraints (e.g., Ferguson & Farwell, 1975; Kiparsky & Menn, 1977; Schwartz & Leonard, 1982).

An analysis of these early words using Nelson's (1973) framework suggested that, like other first-born children of college-educated parents, Sean was a classic Referential child, preferring to produce names and general nominals over personal-social words.

PHASE 2. This phase was signalled by the first points in what appeared to be a "U-shaped developmental curve" in the use of two-word utterances. During a week's period, at around 15 months of age, Sean spontaneously produced a number of 2-word utterances using the pivot words "byebye" and "no", always in initial position. Although only these two relational words were used, they occurred in isolation and also were combined productively with nominals already available in his lexical repertoire, for example, "bird, daddy, kitty, ball, light, baby."

PHASE 3. Interestingly, these two-word utterances dropped out abruptly at the onset of Phase 3, coinciding with an equally abrupt reorganization of syllable structure, the appearance of a pervasive and extremely consistent consonant harmony rule, and a rapid increase in the rate of vocabulary acquisition.

Recall that the phonetic forms or words used in Phases 1 and 2 conformed to the "only one consonant per word" rule,such that no consonant harmony rule was necessary or even applicable. However, at around 15 months, the phonetic forms of already-established target words and newly acquired words were governed by a rule requiring that all stop and nasal consonants be formed at the same place of articulation.

This is not an atypical pattern. Several other investigators (Ingram, 1976; Vihman, 1978; Menyuk & Menn, 1981) have noted the same developmental sequence: fairly slow word acquisition until, typically at around the 50-word point, the child "hits on an orderly way of discarding enough information for him to be able to handle the words" (Menn, 1974, p. 8). Consonant harmony can be a particularly powerful simplifying rule in that it functions to "increase the redundancy of the articulation instructions in the word" (Kiparsky & Menn, 1977, p. 59). In Sean's case, (and also for Daniel Menn (Menn, 1971)), his new consonant harmony rule allowed him to make a stab at a much larger set of target words, (i.e., those with two dissimilar consonants), which resulted in a sudden spurt in rate of vocabulary acquisition. In 3 months, Sean's productive repertoire grew from about 35 words to over 150 words. Stoel-Gammon and Cooper (1984) also suggest that children whose phonological systems can be characterized by selection strategies and preferred articulatory

routines may show a more rapid rate of lexical acquisition than other children.

The use of phonological selection strategies seems to go hand-in-hand with consonant harmony's goal of decreasing articulatory load. Consistent with other data, Sean seemed to prefer words with bilabials, and to avoid target words involving velars. He not only still had no velars in his phonetic repertoire by Phase 3, but he also seemed to be less willing to attempt words with velars, even though his consonant harmony rule effectively provided him with bilabial and alveolar substitutes. At 18 months, with a repertoire of over 150 words, fewer than 20% were targets involving a velar stop, whereas almost half were words containing a bilabial stop or nasal.

In general, then, the consonant harmony rule and the selection strategy conspired to convert all consonants in a word to bilabials, provided that a bilabial stop or nasal occurred in a word. Note that this is a particularly simple consonant harmony rule, in that it applies regardless of the bilabial's position in the word, or whether it occurred with a velar or alveolar. If no bilabials occurred, velars were assimilated to surrounding alveolars, as in "dog" /d>di/ or "duck" /d ∧ t/, or alveolars were substituted for velars, as in "kitty" /titi/. This pattern is consistent with other reports (Menn, 1971; Cruttendon, 1978) that direction of assimilation, i.e., progressive or regressive, is less important than place of articulation in accounting for consonant harmony; bilabials seem to be the strongest attractors of harmony, followed by velars, and then by alveolars. When velars did emerge in Sean's system, in Phase 4, they took priority over the alveolars in assimilation, for example, "doggy" changed from /d > di/ to /g > gi/, and "Katie" from /titi/ to /kiki/.

PHASE 4. This phase was marked by the endpoint in the U-shaped curve, i.e., the re-appearance of 2-word utterances, yet in phonetically different form. Note that this onset of word combinations was late relative to Sean's vocabulary development. For example, Nelson (1973) reported that children's age when the first 10 phrases were used was highly correlated with the age at which the 50-word-point in vocabulary size was reached, averaging about 19 1/2 months. However, although Sean's reappearance of two-word utterances at about 18 months is within the average age range, his vocabulary at that point included well over 150 words. Further, his repertoire contained a number of relational words that typically appear in children's word combinations, e.g., "more, no, allgone, alldone, empty, up, where, want, back." Therefore, his failure to use word combinations up to that point did not seem attributable to limitations in either the number or nature of the single words available to be combined.

Instead, as Waterson (1978) claimed, it appears that two-word utterances would have occurred earlier in Sean's system, or in fact may not have dropped out so precipitously at 15 months, if his consonant harmony rule had not operated across word boundaries. An examination of the kinds of early two-word utterances provides evidence that the consonant harmony rule and selection strategy collaborated in constraining the phonetic shapes that two-word utterances could take in Sean's system. Three kinds of evidence are available.

First, the earliest two-word utterances were governed by the same consonant harmony rules and selection strategies as single words. (Exactly as would be predicted from his early bilabial preference, the long-awaited first

two-word utterance in Phase 4 was "bye-bye poopie"). In other words, Sean seemed to edit possible word combinations such that only those that did not violate consonant harmony restrictions could be produced. This strategy was resistant to parental intervention. For example, in a favorite book that presented pictures of the same objects in varying sizes, Sean willingly labelled "big book, big bird, big ball, big pool," but adamantly refused to name or even imitate "big dog" or "big cooky." Incidentally, during this time, Sean also used two gestalt or unanalyzed phrases, also conforming to consonant harmony specifications, i.e., "I got it" [aidatit] and "I'll do it" [aiduwit].

Interestingly, velar stops began to emerge in single words at about the same point that the two-word phrases reappeared. However, almost all these early word combinations involved bilabials, and to a lesser extent, alveolars, e.g., "no nuk, alldone juice." However, there were 1 or 2 combinations involving velar harmony, e.g., "all gone cooky."

A second strategy, appearing slightly after the two-word consonant harmony approach, suggested that Sean had devised a means of producing two-word combinations by circumventing the consonant harmony rule. Three pivot words, "where [ey$_{\Lambda}$], want [wa], uh-uh [$_{\Lambda}$ow]," always occurring in initial position, were combined with a wide range of already existing words. This was an extremely productive strategy, in that these vocalic words were thus not governable by consonant harmony rules, yet the semantic relations they conveyed applied easily to the large set of nouns in Sean's typically referential vocabulary.

Gradually, more and a wider phonetic range of word combinations began to appear as the consonant harmony rule began to relax and adult-like word forms and their assimilated (consonant harmony) versions occurred in free variation. Interestingly, however, as bilabial and alveolar harmony decreased, velar harmony became stronger and more prevalent. In fact, velar harmony actually caused some adult-like words occurring in isolation to become "mutilated" when occurring in phrases with words involving velars, as in [gaikeki] for "bye Katie". Further, although bilabial and alveolar harmony on the single-word level faded out by about 22 months, velar harmony persisted for several months, particularly in words with velars in final position, such as "doggy" and "ducky."

A final piece of evidence that Sean's use of two-word utterances was delayed by the vise-like grip of these phonological rules was provided by his rapid growth in multi-word combinations as the consonant harmony rules finally weakened. Recall that the two-word utterances reappeared at about 18 months. By 21 months, the average length of Sean's utterances was calculated at 2.1, approximately one standard deviation above the mean relative to Miller and Chapman's (1979) norms (cited in Miller, 1981). Thus, in 3 months, he went from only single word utterances to primarily multi-word combinations. Interpolating from Miller and Chapman's (1979) data, the average child needs about 8 months to progress from the very onset of two-word utterances to a mean length of utterance of 2.0 morphemes.

DISCUSSION

Although the presence of interactions between early phonological systems and developing syntactic and semantic knowledge has been occasionally

mentioned in the literature (Waterson, 1978; Ferguson, 1979), there are little data as to how such an interaction might be manifested. This diary study provides an explicit example of the role that word-level articulatory planning may play in constraining the occurrence and nature of multi-word combinations. In a nutshell, Sean's transition from single-words to two-word utterances can be characterized as a struggle to work within and overcome his consonant harmony rules. It is not likely that this is a typical or even frequently occurring pattern, since few similar reports were available in the literature. In fact, most diary studies do not discuss how or even whether phonological rules change when applied to two-word rather than single-word utterances. However, Scollon (1976) provided some evidence that single words regressed to earlier phonetic forms when occurring in successive word utterances, or "vertical constructions." Similarly, Branigan (personal communication, Oct., 1984) gave an example of consonant harmony between two words occurring in successive word utterances. Finally, in their analysis of their son's progress through the one- and two-word stages, de Villiers and de Villiers (1978) also raise the issues that widely applied simplifying phonological rules may cross word boundaries, thereby delaying the onset of word combinations.

In a study of the speech of somewhat older preschool children, Nelson and Kamhi (1984) found within-group variability in the degree to which children's syntax was affected by phonological demands. Interestingly, however, these interactions or trade-offs between phonological and grammatical complexity were most apparent during periods of transition or reorganization between one syntactic stage and the next. These data suggest that identifying other

possible kinds of phonological or articulatory constraints may be particularly useful in accounting for the considerable individual variation occurring during the transition period from one- to two-word utterances.

For example, Ramer (1976) describes one group of three children who seem very like Sean, in that they can be characterized as "cautious system builders" (Ferguson, 1979). The syntactic acquisition style of these children (the only boys in a group of seven) was typified by relatively slow growth, tight word order constraints, and developmental plateaus. In particular, their language in the transition phase before and during the onset of early combinations included many "presyntactic devices," forms that combined with traditional words but that appeared to convey no meaningful relation. Interestingly, these forms were typically reduplicative (e.g. "car car") or composed of one vowel. Ramer suggests that these forms serve the purpose of easing the child into syntax by reducing the semantic or propositional load. An equally plausible interpretation is that these presyntactic devices were similar to Sean's use of "where, want, uh-oh," in that they enabled the child to free up resources for marking semantic relations by working around phonological constraints.

Although clearly speculative, these hypotheses may help to clarify the tantalizing notion of "language learning styles." As Ferguson (1979) pointed out: "The identification and description of common learning styles in phonological development and the study of their correlation with other developmental characteristics belong high on the agenda of research in developmental psycholinguistics (p.197)."

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TABLE 1

PHASE 1: (12-15 months) Examples of words before consonant harmony rule has emerged; syllabic patterns of (V)CV, VC, or C_1VC_1V.

'up'	[ʌp]	'bird'	[bœ]
'ball'	[bau]	'byebye'	[baɪ]
'water'	[ɔdu]	'no'	[no]
'see'	[si]	'hat'	[æt]
'kitty'	[tyi]	'hello'	[ʌwo]

PHASE 2: (15 months) Two-word utterances appear for a week, then drop out abruptly when consonant harmony rule emerges.

'bye kitty'	[baɪtyi]	'no kitty'	[no tyi]
'bye daddy'	[baɪ dæ]	'no dog'	[nodɔ]
'bye bird'	[baɪ bœ]	'no ball'	[nobau]

TABLE 2

PHASE 3: (15-18 months) Consonant harmony rule emerges on single words; Explosion of vocabulary.

Bilabial___Velar	
'book'	[bʊp]
'bug'	[bʌp]
'bucket'	[bʌpəp]

Bilabial___Alveolar	
'bottle'	[babə[]
'spoon'	[pum]
'Brenda'	[bɛ̨bi]

Alveolar___Bilabial	
'top'	[pap]
'Tommy'	[bami]
'soap'	[pop]
'nipple'	[mɪpə[]

Alveolar___Velar	
'duck'	[dʌt]
'dog'	[dɔdi]
'tick-tock'	[titat]

Velar___Bilabial	
'cup'	[bʌp]

Velar___Alveolar	
'Katie'	[titi]
'coat'	[dot]

Velar___Velar	
'cooky'	[titi]

TABLE 3

PHASE 4: Two-word utterances reappear; evidence that consonant harmony rule applies across word boundaries; velars appear in single words (18-22 months).

A. First two-word utterances follow consonant harmony rule.

'byebye poopy' [baɪbaɪ pupi]
'mommy's baby' [mamibebi]
'bottle mommy' [babəlmami]
'big book' [bɪbʊp]
'big bird' [bɪbœb]
'no nuk' [nonʊt]
'alldone juice' [adʌndus]
'I got it' [aɪdatɪt]
'all gone cooky' [agankʊki]
'baby on bike' [bebiʌbaɪp]

B. Productive use of vocalic "pivot" words, occurring in initial position.

'where baby (doggie, daddy, horsy...)' [ɛyʌbebi]
'want juice (paper, coat, bagel...)' [wə̨dus]
'uh-oh water (kitty, stroller, hammer...)' [ʌˀowadu]

C. As velar harmony becomes more frequent (e.g., 'doggy' becomes /gɔgi/), it applies to two-word utterances.

'bye Katie' [gaɪ keki]
'two duckies' [kugʌkiz]
'big book' [gɪkʊk]
'big goat' [gɪgok]